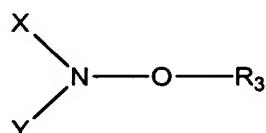


CLAIMS

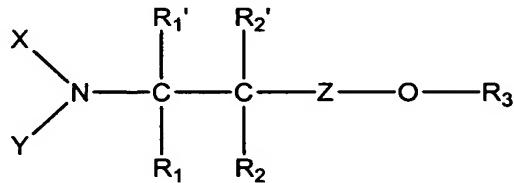
WHAT IS CLAIMED IS:

1 1. An aqueous semiconductor cleaning solution comprising:
2 at least about 75% by weight water;
3 from about 0.5% to about 10% by weight phosphoric acid;
4 at least one alkaline compound selected from the group consisting of: a quaternary
5 ammonium hydroxide; a hydroxylamine derivative having the structural formula:



6

7 wherein R₃ is hydrogen or a linear, branched, or cyclic hydrocarbon containing from 1 to 7
8 carbon atoms; and wherein X and Y are, independently, hydrogen or a linear, branched, or
9 cyclic hydrocarbon containing from 1 to 7 carbon atoms, or wherein X and Y are linked
10 together form a nitrogen-containing heterocyclic C₄-C₇ ring; and a mixture thereof; and
11 optionally one or more other acid compounds, one or more fluoride-containing compounds,
12 and/or one or more alkanolamines having the structural formula:



13

14 wherein R₁, R₁', R₂, R₂', and R₃ are, independently in each case, hydrogen or a linear,
15 branched, or cyclic hydrocarbon containing from 1 to 7 carbon atoms; wherein Z is a group
16 having the formula -(Q-CR₁R₁'-CR₂R₂')_m-, such that m is a whole number from 0 to 3
17 (*i.e.*, when m=0, there is no atom between the -CR₂R₂'- group and the -OR₃ group in the
18 formula above), R₁, R₁', R₂, and R₂' may be independently defined in each repeat unit, if
19 m>1, within the parameters set forth for these moieties above, and Q may be independently
20 defined in each repeat unit, if m>1, each Q being independently either -O- or -NR₃-; and
21 wherein X and Y are, independently in each case, hydrogen, a C₁-C₇ linear, branched, or
22 cyclic hydrocarbon, or a group having the formula -CR₁R₁'-CR₂R₂'-Z-F, with F being
23 either -O-R₃ or -NR₃R₄, where R₄ is defined similarly to R₁, R₁', R₂, R₂', and R₃ above, and
24 with Z, R₁, R₁', R₂, R₂', and R₃ defined as above, or wherein X and Y are linked together
25 form a nitrogen-containing heterocyclic C₄-C₇ ring.

1 2. The aqueous semiconductor cleaning solution of claim 1, wherein the pH of the
2 solution is between about 2 and about 6.

1 3. The aqueous semiconductor cleaning solution of claim 1, wherein the at least one
2 alkaline component comprises a hydroxylamine derivative present in an amount from about
3 0.3% to about 1% by weight.

1 4. The aqueous semiconductor cleaning solution of claim 1, wherein the at least one
2 alkaline component comprises hydroxylamine or N,N-diethylhydroxylamine.

1 5. The aqueous semiconductor cleaning solution of claim 1, wherein the at least one
2 alkaline component comprises a quaternary ammonium compound present in an amount
3 from about 0.5% to about 3% by weight.

1 6. The aqueous semiconductor cleaning solution of claim 1, wherein the at least one
2 alkaline component comprises choline hydroxide.

1 7. The aqueous semiconductor cleaning solution of claim 1, which comprises one or
2 more other acid compounds selected from the group consisting of hydrochloric acid, nitric
3 acid, periodic acid, pyrophosphoric acid, fluorosilicic acid, sulfuric acid, methanesulfonic
4 acid, oxalic acid, lactic acid, citric acid, xylenesulfonic acid, toluenesulfonic acid, formic
5 acid, tartaric acid, propionic acid, benzoic acid, ascorbic acid, gluconic acid, malic acid,
6 malonic acid, succinic acid, gallic acid, butyric acid, trifluoracetic acid, and mixtures
7 thereof.

1 8. The aqueous semiconductor cleaning solution of claim 7, wherein the one or more
2 other acid compounds is glycolic acid, methanesulfonic acid, pyrophosphoric acid, oxalic
3 acid, lactic acid, or citric acid.

1 9. The aqueous semiconductor cleaning solution of claim 1, wherein the one or more
2 other acids are present in an amount from about 0.2% to about 5% by weight.

1 10. The aqueous semiconductor cleaning solution of claim 1, wherein the one or more
2 fluorine-containing compounds are present in an amount from about 0.01% to about 0.1%
3 by weight.

1 11. The aqueous semiconductor cleaning solution of claim 1, wherein the one or more
2 fluorine-containing compounds comprise ammonium bifluoride and/or ammonium fluoride.

1 12. The aqueous semiconductor cleaning solution of claim 1, further comprising an
2 organic solvent in an amount from about 5% to about 15% by weight.

1 13. The aqueous semiconductor cleaning solution of claim 1, wherein the organic
2 solvent comprises an organic acid ester.

1 14. The aqueous semiconductor cleaning solution of claim 1, further comprising a
2 surfactant.

1 15. The aqueous semiconductor cleaning solution of claim 1, further comprising one or
2 more alkanolamines selected from the group consisting of monoethanolamine, 2-(2-
3 hydroxylethylamino)ethanol, 2-(2-aminoethoxy)ethanol, N,N,N-tris(2-hydroxyethyl)-
4 ammonia, isopropanolamine, 3-amino-1-propanol, 2-amino-1-propanol,
5 2-(N-methylamino)ethanol, 2-(2-aminoethylamino)ethanol, and mixtures thereof.

1 16. The aqueous semiconductor cleaning solution of claim 1, wherein the one or more
2 alkanolamines is present in an amount from about 0.5% to about 5% by weight.

1 17. The aqueous semiconductor cleaning solution of claim 1, wherein the solution is
2 substantially free from other acid compounds.

1 18. The aqueous semiconductor cleaning solution of claim 1, wherein the solution is
2 substantially free from fluoride-containing compounds.

1 19. The aqueous semiconductor cleaning solution of claim 1, wherein the solution is
2 substantially free from alkanolamines.

1 20. The aqueous semiconductor cleaning solution of claim 1, wherein the solution
2 contains substantially no additional components.

1 21. The aqueous semiconductor cleaning solution of claim 1, wherein the solution is
2 substantially free from hydroxylamine derivatives.

1 22. The aqueous semiconductor cleaning solution of claim 1, wherein the solution is
2 substantially free from organic solvents.

1 23. The aqueous semiconductor cleaning solution of claim 1, wherein the concentration
2 of water is at least about 85% by weight.

1 24. A dilute aqueous cleaner and residue remover comprising:
2 water, optionally in a mixture with one or more polar organic solvents, wherein the
3 water is present at least about 75% by weight;
4 phosphoric acid or salt thereof, present in an amount from about 0.1% to about 6%
5 by weight of 85% phosphoric acid;
6 optionally, a quaternary ammonium compound, present in the solution in an amount
7 from about 0.2% to about 5% by weight;
8 optionally, a hydroxylamine derivative, present in the solution in an amount from
9 about 0.1% to about 5% by weight not including the counterion of the hydroxylamine
10 derivative salt, if present;
11 optionally, an alkanolamine, present in the solution in an amount from about 0.2%
12 to about 5% by weight;
13 optionally, a fluoride-containing compound, present in the solution in an amount
14 from about 0.001% to about 0.5% by weight;
15 optionally, an other acid compound, present in the solution in an amount from about
16 0.05% to about 6% by weight;
17 optionally, a chelating agent, present in the solution in an amount from about 0.1%
18 to about 8% by weight;
19 optionally, a surfactant, present in the solution in an amount from about 0.01% to
20 about 3% by weight.

1 25. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%
2 to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a
3 hydroxylamine derivative, preferably hydroxylamine; and about 0.005% to about 0.04% by
4 weight of a fluoride-containing compound, preferably ammonium bifluoride.

1 26. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%
2 to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a

3 hydroxylamine derivative; about 0.005% to about 0.04% by weight of a fluoride-containing
4 compound; and about 0.05% to about 0.2% by weight of a surfactant.

1 27. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%
2 to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a
3 hydroxylamine derivative, preferably hydroxylamine; and about 0.005% to about 0.1% by
4 weight of a fluoride-containing compound, preferably ammonium fluoride.

1 28. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%
2 to about 2.5% by weight of phosphoric acid; about 0.5% to about 1% by weight of a
3 hydroxylamine derivative; about 0.005% to about 0.1% by weight of a fluoride-containing
4 compound; and about 5% to about 15% by weight of a polar organic solvent.

1 29. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%
2 to about 2.5% by weight of phosphoric acid; and about 0.5% to about 1.5% by weight of a
3 quaternary ammonium salt.

1 30. A dilute aqueous cleaner and residue remover consisting essentially of: about 1.5%
2 to about 4% by weight of 85% phosphoric acid; about 0.3% to about 4% by weight of
3 oxalic acid dihydrate; about 0.3% to about 4% by weight of a monofunctional organic acid;
4 about 90% to about 99% by weight of water; and optionally between about 0.1% and about
5 1% of a chelator, wherein the formulation contains substantially no organic solvents and
6 SARA 3 hazardous compounds.

1 31. A dilute aqueous cleaner and residue remover consisting essentially of: optionally
2 about 0.5% to about 6% by weight of 85% phosphoric acid; about 2% to about 12% by
3 weight of oxalic acid dihydrate; optionally about 0.2% to about 15% by weight of a
4 monofunctional organic acid; optionally between about 0.05% and 1.5% by weight of
5 ammonium hydroxide, an alkyl ammonium hydroxide substituted with 2 or 3 alkyl moieties
6 independently selected from methyl and ethyl moieties, or a mixture thereof; optionally
7 between about 0.1% and about 1% of a chelator; and water wherein the formulation
8 contains substantially no organic solvents and SARA 3 hazardous compounds.